IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Hiroshi HASEGAWA et al.

U.S. Patent
Appln. No.: 09/057,684

Filed: April 9, 1998

For: Refrigerator oils for use with chlorine-free fluorocarbon refrigerants

DECLARATION

I, Kazuo TAGAWA, declare and state as follows:

1. I am a research worker further researching and improving products of the invention claimed in the above-identified application.

2. I am forty one years old.

3. I graduated from Gunma University, Faculty of Engineering, Department of Synthetic Chemistry Course with a Bachelor's degree of Engineering in 1986, finished the Master Course of Engineering of Gunma University with a Master's degree of Engineering in 1988.

4. I have been employed by NIPPON OIL CO., LTD. since April, 1988, during which I have been engaged in researches in lubricating oils for compressors of refrigerators in the Central Technical Research Laboratory of said company.

5. I have studied the Official Action, dated August 28, 2004, issued in the above-identified application.

6. In order to make clear that the refrigerator oils according to the present invention achieve unexpected results in comparison with conventional ones, I made comparative tests as follows:

COMPARATIVE TESTS

To substantiate new and unexpected results for the mixed esters, which are included in the refrigerator oils of the present invention, based upon molar ratios of 1:3 and 3:1 for two carboxylic acids in which the first carboxylic acid is 2-ethylhexanoic acid and the second carboxylic acid is 3,5,5-trimethylhexanoic acid, I conducted further Comparative Tests as follows:

The refrigerator oils (Test Oil Nos. 1 and 2) which are included in the present invention each of which has a composition indicated in the following Table A, were prepared and then evaluated for their performances that are their insulating property, hygroscopicity and thermal and chemical stability by the same test methods as described in the present specification on pages 16-18. The Comparative Tests were carried out with the base oil alone without any epoxy additive. The results thus obtained are indicated in Table A.

Table A

Test oil No.	Base Oils	Epoxy compounds		Kinematic Viscosity @100℃, (mm^2/s)	Miscibility with R134a, Miscible Temp. Range (℃)	Resistivity @25 (Ωcm)	Falex test Amount of journal worn (mg)	Hygro-scopicity @60℃, 30% (%)	Sealed glass tube tests				Pour point (℃)
		Kind	Amount						Oil color	Catalysts			
										Cu	Fe	Al	
1*	-	None	-	9.0	-30～CT**	$4.2x10^{14}$	26	0.19	4	No change	Luster decrease	No change	-35
2*	-	None	-	6.4	-27～CT**	$3.8x10^{14}$	27	0.19	4	No change	Luster decrease	No change	-45
Ex. 1	1	None	-	8.1	-28～CT**	$4.0x10^{14}$	26	0.19	5	No change	Luster decrease	No change	-45
Comp. Ex. 1	2	None	-	6.2	-27～CT**	$4.1x10^{14}$	27	0.19	4	No change	Luster decrease	No change	0
Comp. Ex. 3	3	None	-	11.5	-32～CT**	$3.8x10^{14}$	25	0.19	4	No change	Luster decrease	No change	10

Note: Test oil No. 1* C8 : C9=1mol : 3mol

Test oil No. 2* C8 : C9=3mol : 1mol

CT**: Critical temperature of HFC-134a (102℃)

As is apparent from the results indicated in Table A, the refrigerator oils (Test Oil Nos. 1 and 2) each of which contains molar ratios of 1:3 and 3:1 for two carboxylic acids in which the first carboxylic acid is 2-ethylhexanoic acid and the second carboxylic acid is 3,5,5-trimethylhexanoic acid, are excellent in pour point temperatures, which exhibit not higher than -10℃, as well as in any of insulating property, hygroscopicity and thermal and chemical stability, like in Examples 1 and 2 according to the present invention indicated in Table 1 of the present specification on page 19.

As clearly described in the present specification on page 11, lines 6-14, the refrigerator oils according to the present invention consisting essentially of a tetraester of pentaerythritol with both 2-ethylhexanoic acid and 3,5,5-trimethylhexanoic acid as the base oil should have such viscosity and pour point as those which are normally suitable for an ordinary refrigerator oil. In addition, they should have a pour point of not higher than -10℃, preferably -20℃ to -80℃, to prevent solidification at a low temperature. Therefore, it is critical to a fluid composition for a refrigerator oil to have a lower pour point.

As is apparent from the results indicated in Table A, Test Oil Nos. 1 and 2, and Example 1 are extremely low in the pour point as compared with those of Comparative Examples 1 and 3 and therefore, the facts that the compositions resulting from the mixed esters would, have a lower pour point than the individual esters would not have been expected by a skilled artisan.

As is also apparent from the results indicated in Table A, Test Oil Nos. 1 and 2, and base oil 1 of Example 1 each have extremely low pour point as compared with those of Comparative Examples 1 and 3 (Base oil 2 and 3) and therefore it would not have been expected by a skilled artisan that the compositions resulting from the mixed esters would have a lower pour point than the individual esters.

I further state that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Dated this March 30, 2005

Signature: Kazuo Tagawa

Kazuo TAGAWA